Amendments to the Claims

This listing of claims will replace all prior versions and listings of claims in the application.

Listing of the Claims

1. (Currently amended) A laser for generating light pulses at a selected operating wavelength or range of wavelengths and a selected fundamental repetition frequency comprising:

(a) one or more optical resonators or a closed optical path where a light pulse can build up over multiple round trips; wherein the one or more resonators or the closed optical path comprises one or more gain mediums and wherein the round trip path length is selected to give the selected fundamental repetition frequency;

(b) one or more pump light sources;

(c) one or more optical couplers for coupling pump light from the pump light source into the one or more gain mediums to provide optical gain at the selected operating wavelength or range of wavelengths;

(d) one or more nonlinear optical or saturable absorber elements or devices optically coupled with the one or more optical resonators or the closed optical path and

(e) one or more optical couplers for coupling light pulses out of the laser wherein one or more of the saturable absorber elements or devices comprise carbon nanotubes, and wherein at least one of the non-linear optical or saturable absorber elements or devices is a mode locker and the laser is self-starting and mode-locked.

2. (Previously presented) The laser of claim 1 further comprising a wavelength tuning element or device optically coupled with the one or more optical resonators or the closed optical path.

3. (Previously presented) The laser of claim 1 wherein the one or more nonlinear optical or saturable absorber elements or devices comprising carbon nanotubes is positioned within one of the one or more optical resonators or within the closed optical path.

4. (Previously presented) The laser of claim 1 wherein the wavelength tuning element is positioned within one of the one or more optical resonators or within the closed optical path.

5.-6. Cancelled

7.–10. Cancelled

11. (Previously presented) The laser of claim 1 in a hybrid mode-locking configuration, which further comprises an active mode-locking device which cooperates with the one or more nonlinear optical or saturable absorber elements or devices to produce optical pulses.

12. Cancelled

13. (Currently amended) ~~The laser of claim 1~~ A laser for generating light pulses at a selected operating wavelength or range of wavelengths and a selected fundamental repetition frequency comprising:

(a) one or more optical resonators or a closed optical path where a light pulse can build up over multiple round trips; wherein the one or more resonators or the closed optical path comprises one or more gain mediums and wherein the round trip path length is selected to give the selected fundamental repetition frequency;

(b) one or more pump light sources;

(c) one or more optical couplers for coupling pump light from the pump light source into the one or more gain mediums to provide optical gain at the selected operating wavelength or range of wavelengths;

(d) one or more nonlinear optical or saturable absorber elements or devices optically coupled with the one or more optical resonators or the closed optical path and

(e) one or more optical couplers for coupling light pulses out of the laser wherein one or more of the saturable absorber elements or devices comprise carbon nanotubes, which is passively Q-switched wherein the one or more nonlinear optical or saturable absorber elements or devices is employed as a Q-spoiler.

14. (Previously presented) The laser of claim 1 capable of generating optical pulses of length about 1 picosecond or less.

15. – 16. Cancelled

17. (Currently amended) ~~The laser of claim 1~~ A laser for generating light pulses at a selected operating wavelength or range of wavelengths and a selected fundamental repetition frequency comprising:

(a) one or more optical resonators or a closed optical path where a light pulse can build up over multiple round trips; wherein the one or more resonators or the closed optical path comprises one or more gain mediums and wherein the round trip path length is selected to give the selected fundamental repetition frequency;

(b) one or more pump light sources;

(c) one or more optical couplers for coupling pump light from the pump light source into the one or more gain mediums to provide optical gain at the selected operating wavelength or range of wavelengths;

(d) one or more nonlinear optical or saturable absorber elements or devices optically coupled with the one or more optical resonators or the closed optical path and

(e) one or more optical couplers for coupling light pulses out of the laser wherein one or more of the saturable absorber elements or devices comprise carbon nanotubes, wherein the laser is capable of generating pulses having energy higher than about 35pJ per pulse or capable of generating pulses having a peak power higher than about 35 W.

18. (Previously presented) The laser of claim 1 wherein the carbon nanotubes comprise single-walled carbon nanotubes (SWNT).

19. Cancelled

20. (Previously presented) The laser of claim 1 wherein the carbon nanotubes are provided in a layer less than or equal to about 10 microns in thickness.

21. Cancelled

22. (Previously presented) A laser for generating light pulses at a selected operating wavelength or range of wavelengths and a selected fundamental repetition frequency comprising:

(a) one or more optical resonators or a closed optical path where a light pulse can build up over multiple round trips; wherein the one or more resonators or the closed optical path comprises one or more gain mediums and wherein the round trip path length is selected to give the selected fundamental repetition frequency;

(b) one or more pump light sources;

(c) one or more optical couplers for coupling pump light from the pump light source into the one or more gain mediums to provide optical gain at the selected operating wavelength or range of wavelengths;

(d) one or more nonlinear optical or saturable absorber elements or devices optically coupled with the one or more optical resonators or the closed optical path and

(e) one or more optical couplers for coupling light pulses out of the laser wherein one or more of the saturable absorber elements or devices comprise carbon nanotubes;

wherein the carbon nanotubes are provided in a layer the thickness of which is varied to adjust the mode-locking and Q-switching threshold optical energy.

23. (Previously presented) The laser of claim 1 wherein the carbon nanotubes comprise 50% or more by weight of semiconductor carbon nanotubes.

24. (Previously presented) The laser of claim 1 wherein the diameters of the carbon nanotubes are selected to exhibit an exciton absorption in the operating wavelength range of the laser.

25. Cancelled

26. (Original) A laser-mode locking element or device comprising one or more layers containing carbon nanotubes.

27. Cancelled

28. (Previously presented) The element or device of claim 26 wherein the carbon nanotubes are SWNTs.

29. (Currently amended) The element or device of claim 26 wherein the diameter of the carbon nanotubes are selected ~~absorb~~ so that the element or device absorbs within a desired operating wavelength range.

30. (Previously presented) The element or device of claim 26 wherein the carbon nanotubes are selected to have a range of different diameters to provide a wide operating bandwidth.

31. Cancelled

32. (Previously presented) The element or device of claim 26 capable of operation in both reflection and transmission mode.

33. Cancelled

34. (Previously presented) A laser-mode locking element or device comprising one or more layers containing carbon nanotubes; wherein the carbon nanotubes are provided in a layer the thickness of which is varied to adjust the mode-locking and/or Q-switching threshold optical energy.

35. (Previously presented) The element or device of claim 26 wherein a layer of carbon nanotubes is provided on a substrate surface.

36. (Currently amended) The element or device of claim 35 wherein the other ~~face~~ surface of the substrate is provided with an AR (anti-reflection) coating, a bandpass filter, or a half-mirror.

37. (Currently amended) A mode-locked pulsed laser comprising ~~the mode-locking element or device of claim 26~~ a laser-mode locking element or device comprising one or more layers containing carbon nanotubes which functions for mode-locking of the pulsed laser.

38. – 40. Cancelled

41. (Previously presented) A method for generating light pulses in a laser which comprises the step of providing a laser-mode locking element or device of claim 26 which comprises carbon nanotubes and which is optically coupled to the resonator of the laser and operating the laser in the mode-locked regime.

42. – 46. Cancelled

47. (Previously presented) A method for generating optical pulses in a laser which comprises the step of Q-switching or mode-locking a laser of claim 1.

48. (Previously presented) The laser of claim 1 wherein the one or more nonlinear optical or saturable absorber elements or devices containing carbon nanotubes are waveguides.

49. (Previously presented) The laser of claim 1 wherein the one or more nonlinear optical or saturable absorber elements or devices containing carbon nanotubes are optical fibers.

50. (Previously presented) The element or device of claim 26 wherein the carbon nanotubes are in a waveguide.

51. (Currently amended) The element or device of claim 26 wherein the carbon ~~nanot5ubes~~ nanotubes are in an optical fiber.

52. (Previously presented) A mode-locked pulsed laser comprising the mode-locking element or device of claim 34.

53. (Previously presented) A mode-locked pulsed laser of claim 1 operating in the picosecond or sub-picosecond regimes.

54. (Previously presented) A mode-locked pulsed laser of claim 37 operating in the picosecond or sub-picosecond regimes.

55. (New) The laser of claim 1 which is an Er-doped fiber laser.

56. (New) The laser of claim 55 which is a ring laser.